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POTENTIALITIES OF THE APPEARANCE OF THE WORKER GUT *IN SITU* FOR THE IDENTIFICATION OF NEOTROPICAL GENERA OF APICOTERMITINAE (ISOPTERA, TERMITIDAE)

by

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Abstract

The coiled gut of the worker caste of the 3 soldierless genera of Apicotermitinae from the Neotropical Region, illustrated for the first time, proved to be valuable in the identification of the genera. A key to genera is provided, based on the worker caste.

Key Words: Isoptera, Neotropical Apicotermitinae, worker gut, key.

Introduction

The importance of the configuration of the worker digestive tube for termite taxonomy was assigned by Sands (1972) in his revision of the African soldierless Apicotermitinae. All the 16 African genera present the same general pattern of coiling of the gut components and are thus easily distinguished from other termites. Johnson (1979) studied the gut configuration of some worker Termitidae and emphasized its taxonomic potentialities for the identification of genera, mainly of the subfamilies Apicotermitinae and Termitinae; according to the morphological variation of some gut parts, it was possible to identify also the species of certain genera. Recently, Fontes (in press) studied the gut anatomy in the worker caste of the 8 genera of soil-feeding nasutes from the Neotropical Region and showed that the gut configuration and the morphology of some gut parts enable the identification of all genera; the same is valid for the identification of many of the remainder 25 Neotropical genera of the subfamily Nasutitermitinae (Fontes, in preparation). The configuration of the worker gut *in situ* has thus proved to be valuable for the taxonomy of the Termitidae.

The aim of this paper is to present a comparative study of the coiled gut of the Neotropical genera of the subfamily Apicotermitinae. The taxonomy of the Neotropical Apicotermitinae is poorly known. The small size and the subterranean habit of most species contribute to the scarcity of good series during collections, and the soldierless status

of all species also contributes to their relative unattractiveness to termite taxonomists. Only 3 genera are described (see Araujo, 1977 and Fontes, 1983 for the species concerned). *Anoplotermes* (Mueller, 1873), with 32 species, is highly heterogeneous and clearly needs a revision involving subdivision. *Ruptitermes* and *Grigiotermes* (Mathews, 1977) include respectively 5 and 2 species. The configuration of the digestive tube *in situ* of the worker caste of these 3 genera was previously unknown, except for a few information given by Mathews (1977).

Material and Methods

The configuration of the gut as visible through the body wall of undissected workers is sufficient for the recognition of the genera of the Neotropical Apicotermitinae. For the present purpose, however, alcohol-preserved workers belonging to the collection of the Museu de Zoologia da Universidade de Sao Paulo (MZSP) and to the author's collection (LRF) were dissected with sharp pincers by removing the abdominal integument, ventral nerve cord, fatty tissues and Malpighian tubules. The exposed gut was immobilized under alcohol in a small Petri dish half filled with white sand and illustrations of dorsal, right, ventral and left views were made with the aid of a camera lucida. Samples studied:

—*Anoplotermes pacificus* Mueller, 1873. Brazil, State of Sao Paulo, Peruibe (Praia do Guarau), 29. VI. 1981. L.R. Fontes col., nest-series number LRF 0078.

—*Grigiotermes bequaerti* (Snyder & Emerson, 1949). Brazil, State of Sao Paulo, Sao Paulo (Morumbi), 31.X. 1950, R.L. Araujo col., nest-series number MZSP 3257.

—*Ruptitermes xanthochiton* Mathews, 1977. Brazil, State of Mato Grosso, 12°49'S, 51°46'W, 1967-1969, A.G.A. Mathews col., nest-series number MZSP 7417, paratypes (B351).

The parts of the worker digestive tube are named as in Fontes (in press).

Results and Discussions

The coiling pattern of the gut of the 3 soldierless genera of Neotropical Apicotermitinae conforms with the pattern presented by the 16 soldierless African genera (Sands, 1972: 9, figs. 4-5; Johnson, 1979: 34, figs. 9-10). The sac-like crop is the foremost part of the digestive tube following the oesophagus. The gizzard is poorly developed and follows the crop in the left side of the abdomen. The mesenteron is tubular and presents an arch with anterior concavity, looping from the left to the right side round the posterior part of the paunch, to join the first proctodeal segment just behind the posterior pair of legs. The mesenteron-proctodeal junction is placed ventrally or ventro-laterally on the right side. The mesenteron commonly joins the first proctodeal segment obliquely to form a mixed segment (Grasse & Noirot, 1954) which always consists of a single extension of the mesenteron on the inner side of the arch, adjacent to the insertion of the Malpighian tubules. The first proctodeal segment is long and tubular, never sac-like, although it may be somewhat inflated. It extends backwards in the left side of the abdomen, looping round the paunch, and posteriorly crosses over to the right side, from where it can reach the dorsum. The first proctodeal segment clearly separates the paunch from the rectum, in ventral view (figs. 3, 7, 11). The enteric valve or second proctodeal segment is located either in ventral, lateral or dorsal position, according to the length of the first proctodeal segment. The paunch or third proctodeal segment forms the central long axis of the gut. The anterior part of the paunch is voluminous and may have a tubular portion for the attachment of the enteric valve. The less voluminous posterior part of the paunch lies dorsally inside the mesenteric arch and narrows progressively to drain into the colon. The colon is divided in two parts. The proximal colon lies inside the mesenteric arch, between the mesenteron and the posterior part of the paunch. It extends to the right and, always bordering the inner face of the mesenteric arch, bends downwards at the right half of the abdomen and loops beneath the mesenteron, from where it continues as the distal colon. In dorsal view, the distal colon runs over the anterior part of the paunch and takes a sinuous or roughly S-shaped route, then terminating in the

rectum. The variably voluminous rectum lies dorsally over the posterior coil of the first proctodeal segment.

The soldierless termites are promptly distinguished from other termites by the configuration of their mixed segment and by the route taken by the first proctodeal segment and distal colon. Details of these structures, and of some other parts of the intestine, further allow the quick identification of the 3 genera of Neotropical soldierless termites.

Ruptitermes (Figs. 1-4) workers are moderately small to large (body length 4-7 mm; head width 0.9-1.8 mm) and forage on the ground surface in the open. The workers developed a peculiar mode of defence by deliberately rupturing themselves on one or both flanks of the anterior part of the abdomen and thus gumming up parts of the attacker's body with the liquid extruded from the salivary glands, which quickly becomes tacky and rubbery (Mathews, 1977 : 102). The salivary glands (mainly the right one) are characteristically very large, filling up to about 1/3 of the abdomen and thus obscuring part of the gut (virtually all the foregut). The mixed segment is short, with the mesenteric lobe moderately swollen at the apex. The first proctodeal segment is shorter than in the other genera. This segment is a narrow tube with constant diameter in the form of an arch whose concavity is directed to the right side; its route is sinuous in left view (Fig. 4). The enteric valve is located dorsally on the right side of the abdomen but is virtually obscured from external view by the distal colon. Three rounded diverticula are developed at the first proctodeal segment at the level of attachment of the enteric valve to the paunch; these are also mostly obscured by the distal colon (Fig. 2). The posterior part of the paunch is thick walled. The distal colon is short, and the rectum is very voluminous.

The workers of *Anoplotermes* and *Grigiotermes* do not forage in the open and defend themselves by defaecating. Their salivary glands (not represented in the figures) are not enlarged, being restricted to the front part of the abdominal chamber, around the oesophageal end and crop.

Anoplotermes workers (Figs. 5-8) are commonly small to very small (body length about 4 mm, or less; head width about 0.7 mm, or less). The mixed segment is long, with the mesenteric lobe strongly swollen at the apex in the form of an egg-shaped bulge alongside the gut. The first proctodeal segment is very elongated, extending across almost all the abdominal length (Figs. 7-8), taking a sinuous route in left view (Fig. 8). It is distinctly enlarged soon after the mixed segment, and in ventral view forms posteriorly an arch with anterior concavity (Fig. 7). The anterior part of the paunch is developed in the form of a tubular neck for the attachment of the enteric valve, the latter being located dorsally to dorso-laterally on the right side of the abdomen. There is no diverticulum at the junction of the paunch and the enteric valve. The posterior part of the paunch is not thick walled. The distal colon is long, and the rectum is moderately voluminous.

Grigiotermes workers (Figs. 9-12) are moderately small (body length 4-5 mm; head width 0.9-1.1 mm). The mixed segment is short, with the mesenteric lobe moderately swollen (more than in *Ruptitermes)* at the apex. The first proctodeal segment is long, extending through most of the abdominal length. Soon after the mixed segment, the first proctodeal segment is inflated and somewhat contorted, being remarkable by its grooved or wrinkled appearance. It is broad and takes a virtually straight route in left view (Fig. 12). The enteric valve is located laterally on the right side of the abdomen, attaching to a tubular neck of the anterior part of the paunch (this neck is shorter in *G. metoecus* Mathews, 1977 although Mathew's figure 36 gives a false impression of absence of this structure). There is no diverticulum at the junction of the paunch and the enteric valve. The posterior part of the paunch is not thick walled. The distal colon is long, and the rectum is moderately voluminous.

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KEY TO THE GENERA OF NEOTROPICAL APICOTERMITINAE, BASED ON THE WORKER CASTE

1. Salivary glands filling up to about 1/3 of the abdomen (Figs.1-4). When touched, living specimens usually rupture the abdomen at the region of the salivary glands. Mixed segment short, with mesenteric lobe moderately swollen at apex (Fig. 3). First proctodeal segment narrow in the form of an arch, with 3 rounded diverticula at apex (Figs. 2-3). Head with scattered erect bristles spacing a little more than their lengths. Foretibia length/foretibia width about 6.7. Index of left mandible about 0.32*. Third marginal tooth of left mandible small, inconspicuous ..... *Ruptitermes*
   Salivary glands small, restricted to the frontal part of the abdomen. When touched, living specimens defaecate vigorously, but are unable of rupturing the abdomen. Mixed segment variable. First proctodeal segment not in the form of an arch and lacking diverticula at apex. Head with dense erect bristles. Foretibia length/foretibia width about 4.0 to 4.7. Index of left mandible about 0.55 to 0.75. Third marginal tooth of left mandible well developed ..... 2.
2. First proctodeal segment enlarged soon after the mixed segment (Fig. 7), sinuous in left view (Fig. 8), in ventral view forming posteriorly an arch with anterior concavity (Fig. 7). Mixed segment long, with mesenteric lobe strongly swollen at apex (Fig. 7). Index of left mandible about 0.55. Point of molar tooth of left mandible hidden beneath the molar prominence. ..... *Anoplotermes*
   First proctodeal segment inflated and somewhat contorted (Fig. 11), straight in left view (Fig. 12), not forming a posterior arch in ventral view (Fig. 11). Mixed segment short, with mesenteric lobe moderately swollen at apex (Fig. 11). Index of left mandible about 0.75. Point of molar tooth of left mandible visible in the gap between the third marginal tooth and the molar prominence ..... *Grigiotermes*

* Mathews (1977: 98) wrongly stated that the left mandible indices are about 0.46 for the alate and 0.40 for the worker. Correct values are 0.36 and 0.32, respectively.

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Worker digestive tube in *situ*, respectively dorsal, right, ventral and left views.

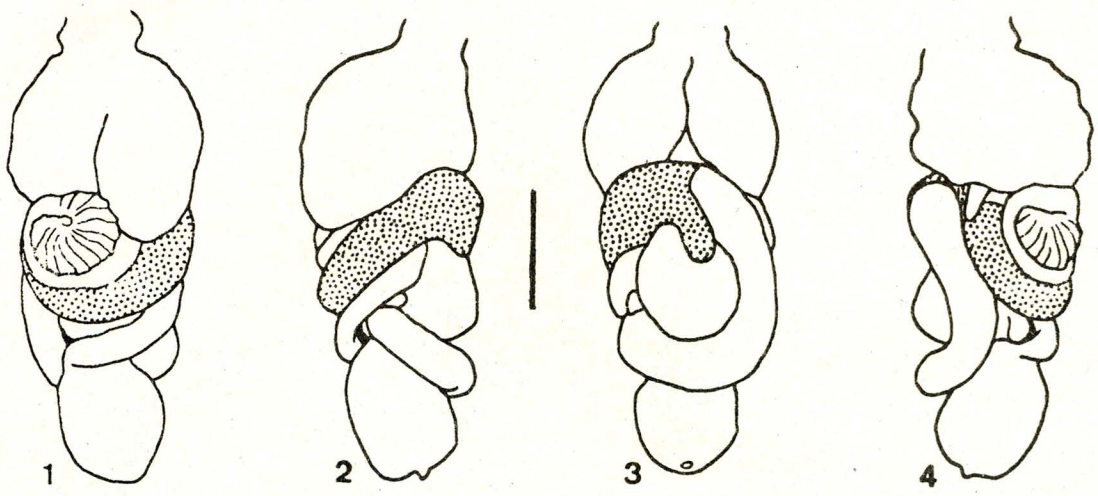

Fig. 1-4, *Ruptitermes xanthochiton;*

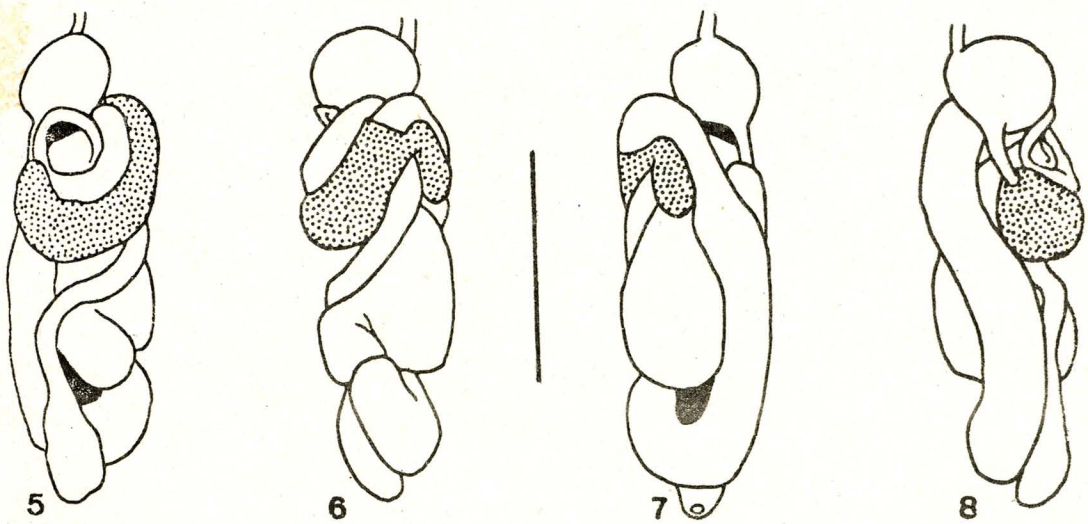

Fig. 5-8, *Anoplotermes pacificus;*

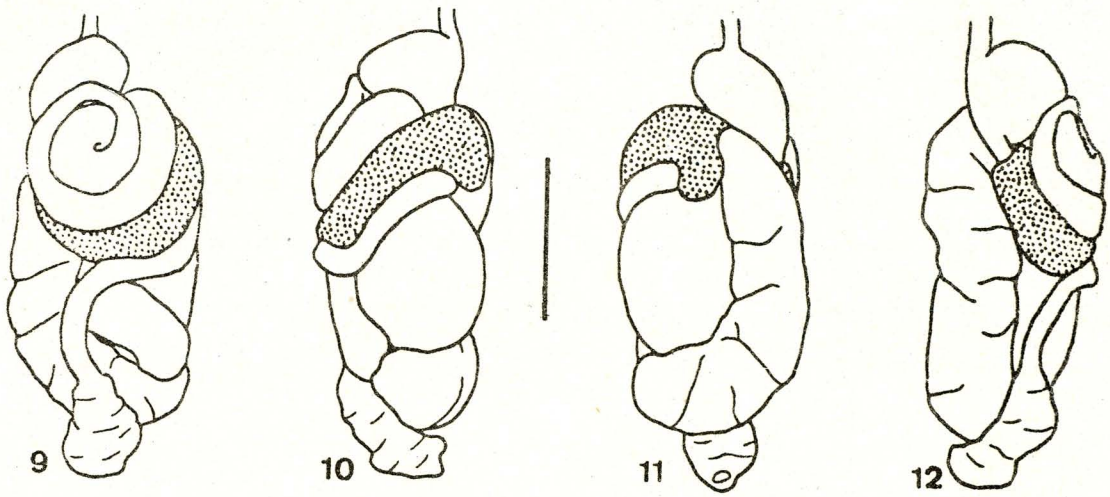

Fig. 9-12, *Grigiotermes bequaerti*. Scales 1 0 millimetre.